DOING THE TWO-STEP

Suggested Grade
4

SD Mathematics Strand & Standard *(Primary for Task)*
Algebra
4.A.2.2. Students are able to simplify a two-step equation using whole numbers.

Task Summary
Students will work with a partner to solve two-step equations.

Time and Context of Task
1 period – 45 minutes

Materials Needed
Paper and pencil, handout included with lesson

Author and Lead Teacher for the Task
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DOING THE TWO-STEP

This task will first be presented by the teacher modeling the steps involved in solving two-step equations and providing examples of two-step equations. The students will then be given the opportunity to work with a partner to solve two-step equations.

1. It takes two steps to solve an equation or inequality that has more than one operation:
   - Simplify using addition, subtraction, multiplication, or division
   - Simplify using the inverse of addition, subtraction, multiplication, or division
2. Here's a two-step equation: $n + 6 = 13 + 2$
3. Solving an equation is like running the equation backwards to discover what number will work in the equation. Now let's work backwards and use inverse operations to undo all the steps.
   - Start with adding $13 + 2$ ($n + 6 = 15$)
   - Next, working backwards, we can subtract 6 from both sides, which is the inverse of adding 6. ($n + 6 – 6 = 15 – 6$)
   - We get an answer of $n = 9$
4. A known fact in solving equations is that the solutions can be checked. The numeric solution is substituted into the original problem. Then the order of operations is used to simplify the remaining solution. Once simplified, both sides of the remaining equation should be equal to each other if the original solution is correct.
   - $n + 6 = 13 + 2$
     $(9) + 6 = 13 + 2$
     $15 = 15$
5. Continuing to use this same process demonstrate how to solve the following two-step equations:
   - $n – 3 = 6 + 2$
   - $n \times 2 = 3 \times 4$
6. Working with a partner students will solve the following two-step equations:
   - $2N = 2 + 8$
   - $2 + N = 2 \times 8$
   - $n + 5 = 15 + 5$
   - $4N = 4 \times 9$
   - $N + 2 = 3 \times 12$

Two-step Equations

$2N = 2 + 8$	$2 + N = 2 \times 8$
$n + 5 = 15 + 5$	$4N = 4 \times 9$

CONTENT STANDARDS

Primary Standard

  Strand Name: Algebra

  SD Goal: Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

  Indicator: Use a variety of algebraic concepts and methods to solve equations and inequalities.

  Standard: 4.A.2.2. Students are able to simplify a two-step equation using whole numbers.

NCTM Process Standards

  Problem Solving

- Build new mathematical knowledge through problem solving
- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving

  Communication

- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Use the language of mathematics to express mathematical ideas precisely

  Connections

- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole

  Representation

- Select, apply, and translate among mathematical representations to solve problems

Problem-Solving Strategies

- Modeling
- Looking for patterns
- Work backward
- Simplifying the problem

ASSESSMENT TOOLS

Chamberlain Elementary Schools
Math Rubric

Name: _____   Teacher: <u>Mrs. Ford</u>

Date Submitted: _____   Title of Work: _____

	Criteria				Points
	4	**3**	**2**	**1**	
Mechanics	No math errors.	No major math errors or serious flaws in reasoning.	May be some serious math errors or flaws in reasoning.	Major math errors or serious flaws in reasoning.	____
Demonstrated Knowledge	Shows complete understanding of the questions, mathematical ideas, and processes.	Shows substantial understanding of the problem, ideas, and processes.	Response shows some understanding of the problem.	Response shows a complete lack of understanding for the problem.	____
Requirements	Goes beyond the requirements of the problem.	Meets the requirements of the problem.	Hardly meets the requirements of the problem.	Does not meet the requirements of the problem.	____
				Total---->	____

Teacher Comments:

Fourth Grade Algebra
Performance Descriptors

Advanced	**Fourth grade students performing at the advanced level:** • solve algebraic equations using inverse operations and order of operations with addition and subtraction using whole numbers; • solve word problems by converting them to algebraic statements; • create patterns to solve problems and justify their solution.
Proficient	**Fourth grade students performing at the proficient level:** • use the commutative property of addition and multiplication; • identify and complete patterns and describe the associated rule; • write and solve number sentences using whole numbers; • simplify a two-step equation using whole numbers; • show relationships between all operations; • simplify whole number expressions in all operations; • select appropriate relational symbols to make number sentences true.
Basic	**Fourth grade student performing at the basic level:** • show relationship between addition and subtraction; • simplify whole number expressions in addition and subtraction; • using whole numbers, solve number sentences.

Fourth Grade Algebra
ELL Performance Descriptors

Proficient	**Fourth grade ELL students performing at the proficient level:** • write and solve number sentences that represent word problems; • use variables as place holders in number sentences; • recognize simple patterns; • identify and complete patterns and describe the associated rule; • read, write, and speak the language of mathematics.
Intermediate	**Fourth grade ELL students performing at the intermediate level:** • solve simple number sentences using the four basic operations and a model; • create numerical expressions from oral or written contexts; • explain in mathematical terms the sequence of steps in solving two-step problems; • give simple oral or written responses to directed questions on topics presented in class.
Basic	**Fourth grade ELL students performing at the basic level:** • write numerals and mathematics symbols; • solve problems using addition, subtraction, and multiplication; • recognize and use basic algebraic terms; • respond to yes or no questions and to problems presented pictorially or numerically in class.
Emergent	**Fourth grade ELL students performing at the emergent level:** • begin to use number sentences using symbolic representations; • give simple oral responses to directed questions on topics presented in class; • copy and write numerals and mathematics symbols; • imitate pronunciation of numbers and mathematical terms; • use non-verbal communication to express mathematical ideas.
Pre-emergent	**Fourth grade ELL students performing at the pre-emergent level:** • observe and model appropriate cultural and learning behaviors from peers and adults; • listen to and observe comprehensible instruction and communicate understanding non-verbally.

DOING THE TWO-STEP
Student Work Samples

As you examine the samples, consider the following questions:

- In light of the standard/s addressed and the assessment tools provided, what evidence does the work provide that students are achieving proficiency in the knowledge and skills addressed by the standard/s for the task?

- Is the task/activity well designed to help students acquire knowledge and demonstrate proficiency? Is the task/activity clearly aligned with the standards? In what ways would you adapt the task/activity to better meet the needs of your students?

Student Work Sample #1

Two-step Equations

$2N = 2 + 8$

$2 \times N = 10$

$10 \div 2 = 5$

$N = 5$

$2 \times N = 2 + 8$

$2 \times (5) = 2 + 8$

$10 = 10$

$2 + N = 2 \times 8$

$2 + N = 16$

$16 - 2 = 14$

$N = 14$

$2 + N = 2 \times 8$

$2 + (14) = 2 \times 8$

$16 = 16$

$n + 5 = 15 + 5$

$N + 5 = 20$

$20 - 5 = 15$

$N = 15$

$N + 5 = 15 + 5$

$(15) + 5 = 15 + 5$

$20 = 20$

$4N = 4 \times 9$

$4 \times N = 36$

$36 \div 4 = 9$

$N = 9$

$4 \times N = 4 \times 9$

$4 \times (9) = 4 \times 9$

$36 = 36$

Looking at Student Work – Instructor notes and rating for work sample #1

Chamberlain Elementary Schools
Math Rubric

Name: _____

Teacher: Mrs. Ford

Date Submitted: _1-10-05_

Title of Work: _Two-Step Equations_

	Criteria				Points
	4	3	2	1	
Mechanics	No math errors.	No major math errors or serious flaws in reasoning.	May be some serious math errors or flaws in reasoning.	Major math errors or serious flaws in reasoning.	4
Demonstrated Knowledge	Shows complete understanding of the questions, mathematical ideas, and processes.	Shows substantial understanding of the problem, ideas, and processes.	Response shows some understanding of the problem.	Response shows a complete lack of understanding for the problem.	4
Requirements	Goes beyond the requirements of the problem.	Meets the requirements of the problem.	Hardly meets the requirements of the problem.	Does not meet the requirements of the problem.	4
				Total---->	12

Teacher Comments: Advanced - This work was given an advanced score because the student clearly understood inverse operations and the correct procedure for completing the check.

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Student Work Sample #2

Two-step Equations

$2N = 2 + 8$ $2N = 2+8$
$2N = 10$ $(8) = 2+8$
$\quad -\frac{10}{2}$ $10 = \overset{10}{}$
$\quad \frac{}{8}$

$2+8=10$

$2 + N = 2 \times 8$ $2+N = 2+8$
$2 + N = 16$ $16 = 16$
$\quad 16-2=14$
$N = 14$

$n + 5 = 15 + 5$ $N+5=15+5$
$N+5 = \quad 20$ $20 = 20$
$20-5=15$
$N = 15$

$4N = 4 \times 9$ $4N = 4 \times 9$
$4 \div 36 = 9$ $(9) \quad 36$
$N = 9$ $36 = 36$

Looking at Student Work – Instructor notes and rating for work sample #2

Chamberlain Elementary Schools
Math Rubric

Name: _____

Teacher: Mrs. Ford

Date Submitted: *1-10-05*

Title of Work: *Two-step equations*

	Criteria				Points
	4	**3**	**2**	**1**	
Mechanics	No math errors.	No major math errors or serious flaws in reasoning.	May be some serious math errors or flaws in reasoning.	Major math errors or serious flaws in reasoning.	3
Demonstrated Knowledge	Shows complete understanding of the questions, mathematical ideas, and processes.	Shows substantial understanding of the problem, ideas, and processes.	Response shows some understanding of the problem.	Response shows a complete lack of understanding for the problem.	3
Requirements	Goes beyond the requirements of the problem.	Meets the requirements of the problem.	Hardly meets the requirements of the problem.	Does not meet the requirements of the problem.	3
				Total---->	9

Teacher Comments: *Proficient- This work was given a proficient score because the student accurately solved the 2 problems using the inverse operation of addition and was able to complete the check.*

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This student shows confusion with solving problems with the inverse operation for multiplication. The standard requires the mastery of addition and subtraction. This student meets the requirement.

10

Student Work Sample #3

Two-step Equations

$2N = 2 + 8$

$2 \times N = 2 + 8$

$N \times 2 = \dfrac{10}{2}$

$\overline{10}$

$N = 5$

$2 + N = 2 \times 8$

$2 + N = 16$

$N = 19$

$n + 5 = 15 + 5$

$N + 5 = 15 + 5$

$N = 15$

$4N = 4 \times 9$

$4N = 4 \times 9$

$N = 32$

$'11'$

Looking at Student Work – Instructor notes and rating for work sample #3

Chamberlain Elementary Schools
Math Rubric

Name: _____   Teacher: Mrs. Ford

Date Submitted: *1-10-05*   Title of Work: *Two-step equations*

	Criteria				Points
	4	**3**	**2**	**1**	
Mechanics	No math errors.	No major math errors or serious flaws in reasoning.	May be some serious math errors or flaws in reasoning.	Major math errors or serious flaws in reasoning.	*2*
Demonstrated Knowledge	Shows complete understanding of the questions, mathematical ideas, and processes.	Shows substantial understanding of the problem, ideas, and processes.	Response shows some understanding of the problem.	Response shows a complete lack of understanding for the problem.	*2*
Requirements	Goes beyond the requirements of the problem.	Meets the requirements of the problem.	Hardly meets the requirements of the problem.	Does not meet the requirements of the problem.	*2*
				Total---->	*6*

Teacher Comments: *Basic - This work was given a basic score because the student solved the addition equation successfully, but did not use inverse operations correctly. This student did not complete*

the checks. This student shows some understanding in solving two-step equations and with some one-on-one conferencing or small group instruction will master two-step equations.

INSTRUCTIONAL NOTES

Author Comments

I used this lesson to reteach two-step equations and evaluate the students' understanding of two-step equations. After scoring the students' work, I had more insight into what skills I needed to focus on as I helped students in small groups successfully learn how to solve two-step equations.

I included two-step equations with multiplication, requiring the inverse operation, division, to determine different levels of understanding.

I had students work individually to complete the two-step equations. The assignment could also be completed with a partner first, and then provide an opportunity for the students to complete the assignment individually.

Resources

SD Mathematics Content Standards
http://www.doe.sd.gov/contentstandards/math/index.asp
SD Assessment and Testing
http://www.doe.sd.gov/octa/assessment/index.asp
The National Assessment of Educational Progress (NAEP)
http://www.doe.sd.gov/octa/assessment/naep/index.asp
National Council of Teachers of Mathematics
http://nctm.org/
Looking at Student Work
http://www.lasw.org/index.html